4-WIRE TANDEM (4WTDM) CHANNEL UNIT, 628260

GENERAL DESCRIPTION

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1. GENERAL

1.01 This Section provides a general description of the ITT D448 4-wire tandem (4WTDM) channel unit, 628260 (Fig. 1), to the functional block diagram level.

1.02 Whenever this Section is reissued, the reasons for reissue will be listed in this paragraph.

1.03 The unit provides a voice frequency (VF) and signaling interface between another 4WTDM channel unit and the D448 multiplex terminal common equipment. In the transmit direction, the unit converts VF and signaling information into pulse code modulation (PCM) for application to the common equipment. In the receive direction, the unit decodes received PCM into VF and signaling information. During system outages, the unit provides various disconnect/make-busy routines for the trunk. The unit provides a 600-ohm, 4-wire, 2-way dual signaling message circuit.

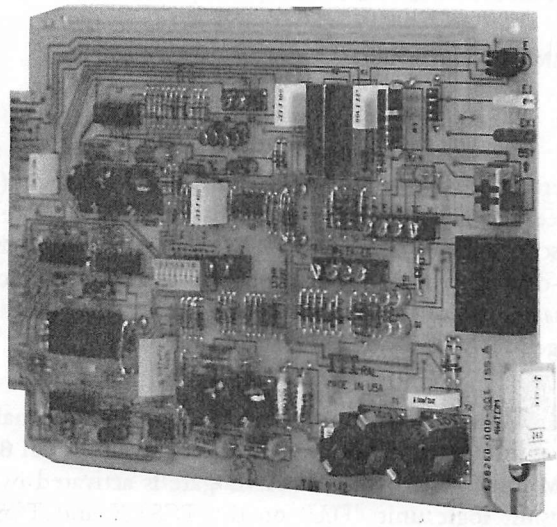

Fig. 1—4WTDM Channel Unit, 628260

2. DESCRIPTION

2.01 The unit mounts in the D448 multiplex shelf (channel unit mounting section) in connectors J1A through J24A (for Digroup A) or connectors J1B through J24B (for Digroup B). Installation procedures for the unit are provided in Section ITTR-18-441.

2.02 The unit is available in Group -0 only.

2.03 The unit consists of an epoxy-glass printed circuit board (PCB) and associated circuit components. The lower front edge of the PCB is fitted with a handle to facilitate insertion and removal of the unit from the shelf. An identification strip on the handle face indicates the unit mnemonic (4WTDM), last three digits of the model number, last three digits of the part number, and issue letter. The part number and issue letter are also located on the component side of the PCB.

2.04 The E LED (DS1), the BSY switch (S2), the splitting card jack (J1), and E1 and EX1 tip jack test points (TP1 and TP2) are located on the front edge of the PCB.

2.05 Printed circuit wiring is etched on both sides of the PCB. The unit inputs and outputs are terminated

in gold-plated contacts on the rear edge of the PCB. These contacts mate with a 60-pin contact edge connector on the rear of the multiplex shelf.

3. FUNCTIONAL OPERATION (FIG. 2)

TRANSMIT VF CIRCUIT

3.01 The incoming VF is transformer-coupled to the low-pass/high-pass filter where it is amplified and filtered. The resulting signal is passed to the transmit (TX) office wiring loss (OWL) compensation circuit. The TX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal applied to the encoder to compensate for office wiring/cabling losses. The resultant range for input levels is −2.1 to −3.6 dBm.

3.02 The encoder converts the VF signal and signaling information (Para. 3.05 through 3.09) to an 8-bit PCM word. When the TX AND gate is activated by the transmit logic unit (TLU) on the TCS4-X and TCS6-X leads, the 8-bit word is applied to the TLU via the TCD bus. The data is clocked out of the unit under control of the 1.536-MHz clock from the TLU.

RECEIVE VF CIRCUIT

3.03 An 8-bit PCM word from the receive logic unit (RLU) is applied to the decoder on the RCD bus. The decoder will only accept the data when the receive (RX) AND gate is activated by the RLU on the RCS4-X and RCS6-X leads. The decoder converts the PCM word into a VF signal and signaling information (Para. 3.10 through 3.13).

3.04 The VF signal is applied to the low-pass filter and passed through to the RX OWL compensation circuit. The RX prescription OWL options provide 0 to 1.5 dB of gain in 0.1-dB steps to the signal out of the low-pass filter to compensate for office wiring/cabling losses. The output of this circuit is further amplified and then transformer-coupled to the interfacing 4WTDM channel unit. The resultant range for output levels is −2.1 to −0.6 dBm.

TRANSMIT SIGNALING

3.05 The unit receives the signaling conditions from the interfacing 4WTDM channel unit.

3.06 An open (on-hook) or ground/loop (off-hook) on the EX lead is detected by the EX/EX1 detector and forwarded, via the TX interface #1, to the encoder. Option screw [S] or [T] matches the unit to the far-end channel unit (Table A).

TABLE A

FAR-END CHANNEL UNIT	OPTION (SCREW-DOWN OR STRAPPING)								
	TX SIG					RX SIG			
	[R]	[S]	[T]	[D3T]	[D2T]	[Y]	[Z]	[D3R]	[D2R]
All 2-State Signaling Units	x	x	o	x	o	o	x	x	o
FXO, D3	o	x	o	x	o	x	o	x	o
FXO, D2	o	x	o	o	x	o	x	x	o
FXS, D3	o	o	x	x	o	o	x	x	o
FXS, D2	o	x	o	x	o	o	x	o	x

x = Option is selected (screw is down or strap is in).
o = Option is not selected (screw is up or strap is out).

3.07 An open or ground/loop on the EX1 lead is detected by the EX/EX1 detector and forwarded, via the TX interface #2, to the encoder. Strapping option [V] allows the EX1 lead signaling condition to be simplexed from the T1 and R1 leads. Strapping option [D3T] or [D2T] matches the unit to the far-end channel unit (Table A).

3.08 Whenever the far-end channel unit is a 2-state signaling unit, option screw [R] must also be selected to place the output of the TX interface #1 on both SIG inputs to the encoder.

3.09 The encoder will not pass the received signaling information until signaled by the TLU on the TA/B lead that the appropriate signaling frame is upcoming.

RECEIVE SIGNALING

3.10 The decoder converts receive signaling information from the 8-bit PCM word when it is signaled by the RLU on the RA/B lead that the signaling frame is being processed by the terminal. The decoded signaling information is applied to one of the RX latches. Each RX latch is associated with a different signaling frame.

3.11 During intermittent terminal failures (momentary failures), the RX latch is inhibited from processing

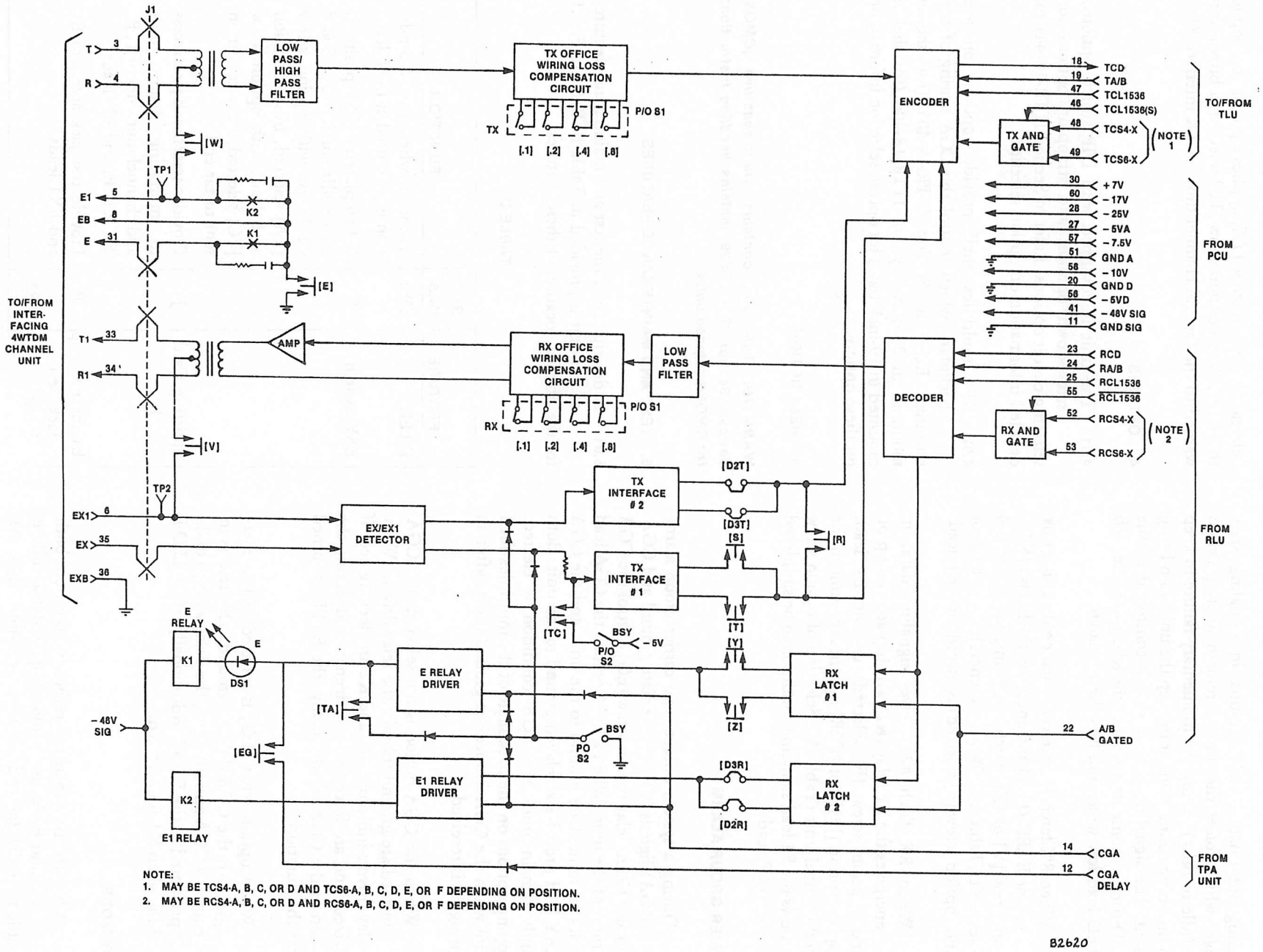

Fig. 2—4WTDM Channel Unit, 628260, Functional Block Diagram

signaling information. This results in signaling state storage, which forces the unit to remain in its previous state (idle or busy) during the momentary failure to keep from dropping connections or to keep the unit from being accessed. The signaling state storage is controlled by the RLU. During a momentary failure, the RLU forces the A/B GATED lead low which inhibits the RX latch.

3.12 When RX latch #1 receives signaling data, it turns on the E LED (DS1) and energizes the E relay (K1). Option screw [Y] or [Z] matches the unit to the far-end channel unit (Table A). With K1 energized, a loop or ground (option screw [E] selected) is placed on the E lead.

3.13 When RX latch #2 receives signaling data, it energizes the E1 relay (K2) which places a loop or ground (option screw [E] selected) on the E1 lead. Strapping option [D3R] or [D2R] matches the unit to the far-end channel unit (Table A). Selection of option screw [W] allows the E1 lead signaling condition to be simplexed on the T and R leads.

CARRIER GROUP ALARM

3.14 During a system outage, two carrier group alarm (CGA) signals (CGA immediate ground and CGA delay) and CGA delay option screw [EG] control the CGA functions of the unit. When a CGA occurs, the CGA lead provides an immediate ground to the unit, and the CGA DELAY lead provides a delayed ground to the unit. Both grounds remain until the CGA condition is cleared. Strapping options on the backplane of the multiplex shelf control when the CGA immediate ground occurs after an alarm signal is received.

3.15 When the CGA option is not selected, the CGA immediate ground inhibits the relay drivers. With the relay drivers inhibited, K1 and K2 are deenergized, if energized, and are forced to stay deenergized during the duration of the CGA. Additionally, the E LED is turned off for the duration.

3.16 When option screw [EG] is selected, K1 is energized by the CGA delayed ground. This results in an idle upon a CGA and following the delay a busy condition is presented at the E lead. Additionally, the E LED is turned on when K1 is energized.

BUSY MODE

3.17 When the BSY switch is in the BSY position, both the E and E1 leads are forced open and an idle is forwarded to the far end on both signaling highways. Selection of option screw [TA] applies a ground or loop to the E lead. With option screw [TC] selected, a busy is forwarded to the far-end channel unit via TX interface #1.

4. OPTIONS

4.01 The unit is equipped with DIP switch options, screw-down options, and strapping options for selecting circuit options. Refer to Section ITTR-18-441 for detailed information on option selection.

4.02 The multiplex shelf provides options on the backplane which control the CGA timing of the terminal. Refer to Section ITTR-18-405 (for shelves mounted in 23-inch bays) or ITTR-18-406 (for shelves mounted in 19-inch bays) for option selection information on these options.

5. RESTRICTIONS

WARNING: This unit contains static-sensitive (CMOS) devices. Section ITTR-18-599 contains handling instructions for CMOS-equipped units.

6. TEST AND MAINTENANCE FEATURES

6.01 A description of the test and maintenance features of the unit is provided in Table B. Refer to Fig. 1 for the physical location of these features.

TABLE B

FEATURE	REF. DES.	FUNCTION
E LED	DS1	Turns on when a busy condition is presented at the E lead.
BSY Switch	S2	When placed in BSY position, causes idle condition at E and E1 leads; with option screw [TA] selected, busy condition at E lead; with option screw [TC] selected, busy condition sent to far end.
Splitting Card Jack	J1	Provides test/break jack access to interfacing channel unit and channel unit sides of T, R, T1, R1, E, and EX leads.
E1 and EX1 Tip Jack Test Points	TP1 and TP2	Provide test jack access to E1 and EX1 leads.

7. TECHNICAL SUMMARY

7.01 A summary of technical specifications for the unit is given in Table C.

TABLE C

ITEM	SPECIFICATION
DC POWER	
Voltage	**Current Drain (nominal)**
GND (+5V)	20 to 28 mA, depending upon signal conditions
−10V (at +5V)	2.0 mA
+7V (at +12V)	5.0 mA
−17V (at −12V)	3.5 to 7.0 mA, depending upon signal conditions
−48V Signaling Battery	1.5 to 23.0 mA, depending upon signal conditions
VF PERFORMANCE	
Impedance	600 ohms balanced
Levels	
Transmit	−2.1 to −3.6 dBm, adjustable in 0.1-dB steps
Receive	−0.6 to −2.1 dBm, adjustable in 0.1-dB steps
Loss Stability (End-to-End)	±0.5 dB over life in 95% of the circuits
Tracking (End-to-End)	
−37 to +3 dBm0 Input	0.5 dB maximum deviation
−50 to −37 dBm0 Input	1.0 dB maximum deviation
Idle Channel Noise (End-to-End)	23 dBrnc0 maximum
Signal-to-Distortion	
0 to −30 dBm0 Input	33 dB minimum overall; 35 dB minimum receive or transmit
−40 dBm0 Input	27 dB minimum overall; 29 dB minimum receive or transmit (deviation to 1 dBrnC for −21 dBm TLP)
−45 dBm0 Input	22 dB minimum overall; 25 dB minimum receive or transmit (deviation to 1 dBrnC for −20 dBm TLP)
Single Frequency Distortion (at 0 dBm0)	
Input Swept from 0 to 12 kHz	−28 dBm0 at any other frequency
Input between 1004 and 1020 Hz	−40 dBm0 or less at any other frequency of 0 to 4 kHz with a distortion contribution objective from either transmit or receive of typically 6 dB better
Return Loss	
1000 Hz	28 dB minimum
300 to 3000 Hz	23 dB minimum
Frequency Response (Referenced 1020 Hz End-to-End)	
200 Hz	0, −3.0 dB
300 to 3000 Hz	±0.3 dB
3200 Hz	+0.3, −1.5 dB
3400 Hz	0, −3.0 dB
Longitudinal Balance (AT&T or IEEE Method)	
At each port with simplex lead open	
200 Hz	86 dB minimum
1000 Hz	80 dB minimum
3000 Hz	78 dB minimum
With 300 ohms between simplex lead and ground	
200 Hz	66 dB minimum
1000 Hz	60 dB minimum
3000 Hz	58 dB minimum
SIMPLEX OPERATION (AT EACH VF PORT)	
Simplex Lead Current (Sum of Tip and Ring Current)	60 mA maximum
Current Unbalance (Difference Between Tip and Ring Current)	1.5 mA maximum
SIGNALING	
Threshold Voltage (EX and EX1 Leads)	
GND	1 k ohm between EX or EX1 lead and −9V
OPEN	30 k ohms between EX or EX1 lead and +9V
Pulsing Distortion	
Input	8 to 12 pps, 30 to 90% break
Output	±2.0% maximum when averaged over continuous pulsing

TABLE C (CONT)

ITEM	SPECIFICATION
OPERATING ENVIRONMENT	
Temperature	0 to +55°C
Humidity	To 95% at 40°C (no condensation)
Altitude	To 14,000 ft (4,300 m)
DIMENSIONS	
Width	0.8 in. (1.9 cm)
Height	5.9 in. (15.0 cm)
Depth	9.7 in. (24.6 cm)
WEIGHT	0.5 lb (0.2 kg)

8. REPLACEABLE PARTS

8.01 This unit has no field-replaceable parts.

9. REFERENCES

9.01 The engineering drawings noted in Table D were used in the preparation of this Section.

TABLE D

TYPE	DRAWING NO.
Assembly	628260-000
Schematic	628260-002

9.02 Related information on the unit may be found in the ITTR Sections referenced in Table E.

TABLE E

TITLE	SECTION NO.
Connectorized Multiplex Shelf (MS/WC7, MS/WC5, MS/C7 and MS/C6), 628001, 628005, 628011 and 628015 (For 23-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-405
Connectorized Multiplex Shelf (MS19/WC7, MS/19/WC5, MS19/C7 and MS19/C6), 628003, 628008, 628013 and 628018 (For 19-Inch Bays) — Option Selection, Installation and Pretest	ITTR-18-406
Special Service Channel Units — Option Selection and Installation	ITTR-18-441